

## SUDDEN DAY LENGTH VARIATION IN JANUARY 1974

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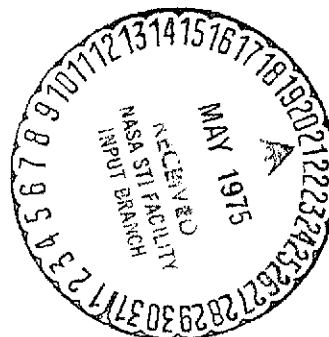
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## SUDDEN DAY LENGTH VARIATION IN JANUARY 1974\*

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The position of a space probe is measured from Earth stations; 293\*\* to provide for its navigation, the position of Earth in space must be known. Three parameters are of primary importance on the one hand because they weight heavily in the balance of errors, on the other hand, because they are unpredictable with the required precision; they are the two coordinates of the instantaneous pole of rotation with respect to Earth,  $x$ ,  $y$ , and above all, the difference between universal time and the international atomic time,  $TU\ 1 - TAI$ , which defines the angle of rotation.

For this purpose, the International Bureau of Time, located at the Paris Observatory was established in 1971, with the financial support of the US's NASA, a high-speed publication service of  $x$ ,  $y$ ,  $TU\ 1 - TAI$ . The operation of this service was made possible thanks to the cooperation of approximately 15 observatories selected for the quality of their work and their geographic distribution. Moreover, the polar coordinates obtained by measuring radial velocities of artificial satellites are being used [1]. The astronomical and space results are reduced with minimum delay and transmitted by teletype to the International Bureau of Time.

The main user of this high-speed service is the Jet Propulsion Laboratory, responsible for the guidance of the Mariner space probes. During the critical periods of the travel of a probe (trajectory corrections, planetary fly-bys), the values of  $x$ ,  $y$  and  $TU\ 1 - TAI$  are calculated and transmitted daily by the International Bureau of Time. This is the case for the interval

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\* Meeting on February 4, 1974

\*\* Numbers in the margins indicate pagination in the foreign text.

of time from January 11 to February 27, 1974 during which Mariner 10 will fly by Venus on February 5 and will have its course diverted in the direction of Mercury which it will reach on March 29. Three trajectory corrections have been planned. At that time, the International Bureau of Time required an additional observation effort on the part of the observatories, so that it will be possible for it to communicate the daily values of  $x$  and  $y$  within approximately 0.02 sec and of  $TU\ 1 - TAI$  with a tolerance of approximately 0,002 sec within the space of 1 to 2 days.

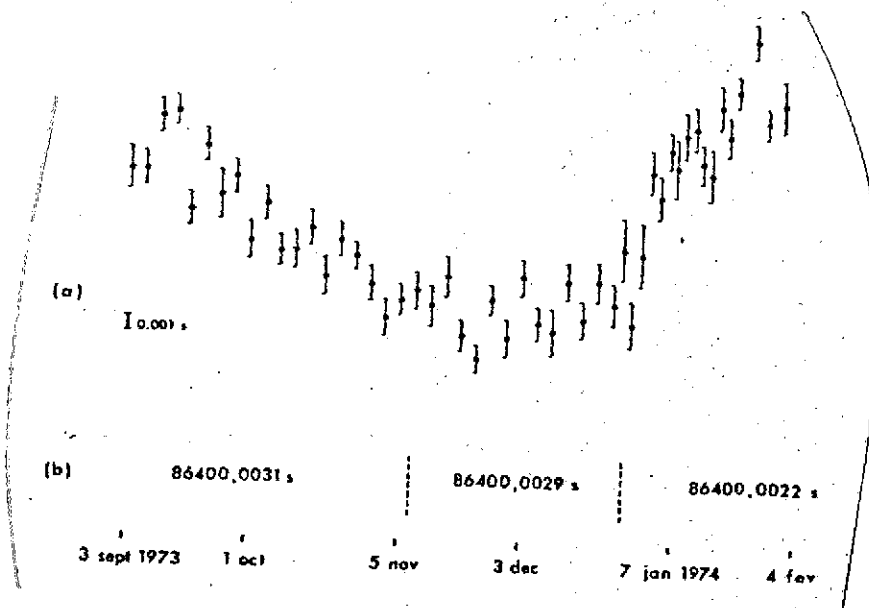
These provisions have permitted recognizing and following with an accuracy never before attained a perturbation of an exceptional amplitude of the Earth rotation which occurred late in 1973.

Since January 1972, the average day length (adjusted to take into account seasonal effects) exceeded 86,400 sec (of the international second) by 0.0030 to 0.0033 sec. At the end of December 1973, a period of irregularities began whose average effect has been an acceleration of the Earth rotation, so that the excess of the day length became 0.0020 sec by the end of January. Thus, within a few weeks, the day length decreased by 0.001 sec. The figure shows a variation of  $TU\ 1 - TAI$ .

Similar events, but of a lesser amplitude, have already been /294 observed. Since 1967, which marked the beginning of the series of values of  $TU\ 1 - TAI$ , calculated every 50 years by the International Bureau of Time, it has been possible to note several perturbation intervals in April 1968, March 1971 [2] and December 1971. The most pronounced event, in March 1971, was accompanied by a long-lasting change of the day length: an increase of 0.0005 sec.

We do not yet have an accurate explanation of this family of events; nevertheless, a recent study has given evidence of a correlation between the circulation of winds up to an approximate

altitudes of 30 km and of irregularities in the Earth rotation on an annual scale [3]. It is quite plausible that the effects which we have just mentioned are also associated with global perturbations of atmospheric circulation, however, over a shorter period of time.



Earth rotation from September 1973 to  
January 1974

- a) TU 1 - TAI correct for one linear term and seasonal variations
- b) Average day length

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